

**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.
177/527929

Total Pages
26

First Named Inventor or Application Identifier

Seiji KAWASAKI

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

Assistant Commissioner for Patents
ADDRESS TO: Box Patent Application
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1. ☒ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. ☒ Specification [Total Pages 12]
(preferred arrangement set forth below)
- Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 USC 113) [Total sheets - 8]
4. Oath or Declaration [Total Pages - 3]
- a. ☒ Newly executed (original or copy)
- b. ☐ Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]
- i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference
(usable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)
7. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
- a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(b) Statement [] Power of Attorney
(when there is an assignee)
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure [] Copies of IDS
Statement (IDS)/PTO-1449 Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
14. ☐ Small Entity Statement(s)
[] Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
16. ☐ Other

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:
[] Continuation [] Divisional [] Continuation-in-part (CIP) of prior application No.

18. CORRESPONDENCE ADDRESS

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Seiji KAWASAKI :
Serial No. [Not yet assigned] : Attn: APPLICATION BRANCH
Filed July 31, 1998 : Docket No. 177/527929
RECLINING SEAT :

PATENT OFFICE FEE TRANSMITTAL FORM

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Sir:

Attached hereto is a check in the amount of \$ 830.00 to cover Patent Office fees relating to filing the following attached papers:

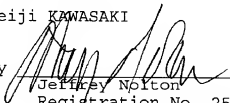
New application \$ 790.00
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A duplicate copy of this paper is being submitted for use in the Accounting Division, Office of Finance.

The Commissioner is authorized to charge any deficiency or to credit any overpayment associated with this communication to Deposit Account No. 23-0975, with the EXCEPTION of deficiencies in fees for multiple dependent claims in new applications.

Respectfully submitted,

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[Check No. 29400]

TITLE OF THE INVENTION

Reclining Seat

BACKGROUND OF THE INVENTION

(Field of the Invention)

5 The present invention relates to a reclining seat suited for use in an automotive vehicle and capable of appropriately adjusting the angle of inclination of a seat back relative to a seat cushion.

(Description of Related Art)

10 A conventional automobile reclining seat includes a sector gear fixed to a seat back and a worm gear rotatably mounted in a seat cushion so as to be engageable with the sector gear. The worm gear is connected to an operating shaft, and engagement of the worm gear with the sector gear is released by pulling the operating shaft in a direction axially thereof and subsequently lifting it. Under this condition, the angle of inclination of the
15 seat back can be easily and rapidly changed by applying a load to the seat back. When the operator releases the operating shaft, the worm gear engages with the sector gear again to retain the angle of inclination of the seat back. In the case where fine adjustment of the angle of inclination of the seat back is required, rotation of the operating shaft causes rotation of
20 the worm gear, which in turn causes a gradual rotation of the sector gear in engagement with the worm gear, making it possible to steplessly change the angle of inclination of the seat back to a desired one (see, for example, Japanese Utility-Model Publication (examined) No. 42-7950).

25 Another conventional automobile reclining seat includes a worm wheel fixed to a seat cushion and a worm gear rotatably mounted in a seat back with the worm wheel being in engagement with the worm gear.

 The worm gear has a groove defined therein to loosely receive a peripheral edge of the worm wheel. When the peripheral edge of the worm wheel is

inserted into the groove of the worm gear by rotating a handle connected to the worm gear, engagement of the worm gear with the worm wheel is released, making it possible to change the angle of inclination of the seat back to a desired one. After the angle of inclination of the seat back has been changed, release of the handle causes a spring to rotate the worm gear by 90°, resulting in a locked condition in which the worm gear is again held in engagement with the worm wheel. If the handle together with the worm gear is rotated gradually, the worm wheel in engagement with the worm gear is also rotated gradually, enabling fine adjustment of the angle of inclination of the seat back (see, for example, Japanese Patent Publication (examined) No. 52-9892).

Furthermore, a reclining seat having a sector gear fixed to a seat back frame and a lock gear in engagement with the sector gear is known wherein the angle of inclination of the seat back can be appropriately changed by manually releasing engagement of the sector gear with the lock gear.

In each of the above-described conventional reclining seats, however, after mating parts such as the sector gear, the worm gear or the like have been incorporated into the seat back, the seat back must be covered with a cushioning material of at least about 35 millimeters thick to remove a sense of foreign substances, making it difficult to provide easy-to-make reclining seats.

Also, it is the general practice that when a relatively large impact is applied to the reclining seat due to, for example, a vehicle collision, impact energy is generally absorbed by deformation of the sector gear or the like. However, some of the conventional reclining seats cannot fully absorb such large impact energy.

Moreover, because a greater trochanter of a seat occupant is

spaced a distance away from the center of rotation of the seat back, the hip of the seat occupant slides on the seat in inclining the seat back, thus giving the seat occupant an unpleasant feeling.

SUMMARY OF THE INVENTION

5 The present invention has been developed to overcome the above-described disadvantages.

It is accordingly an objective of the present invention to provide a reclining seat capable of steplessly adjusting the angle of inclination of the seat back and effectively absorbing impact energy.

10 Another objective of the present invention is to provide the reclining seat of the above-described type which is comfortable and can be readily manufactured at a low cost.

15 In accomplishing the above and other objectives, the reclining seat according to the present invention includes a seat cushion, a seat back pivotally mounted on the seat cushion and having a center of rotation, and a reclining mechanism for inclining the seat back relative to the seat cushion. The reclining mechanism has a center of rotation spaced apart from the center of rotation of the seat back. The center of rotation of the seat back is positioned closer than the center of rotation of the reclining
20 mechanism to a seat occupant.

Advantageously, the seat cushion has a seat cushion frame accommodated therein and the reclining mechanism includes first and second links having respective first ends rotatably mounted on the seat cushion frame and also having respective second ends connected to each
25 other. The first end of the first link is employed as the center of rotation of the seat back, while the first end of the second link is employed as the center of rotation of the reclining mechanism.

The reclining seat preferably includes a sector gear connected

to the first end of the second link and a worm gear rotatably mounted on the seat cushion and being in mesh with the sector gear. Each of the sector gear and the worm gear has a lead angle greater than an angle of friction thereof. When locking of the worm gear has been released, the seat back is inclined by applying a force to the seat back.

Conveniently, the reclining seat includes a lock member mounted on the seat cushion and having internal teeth formed therein. In this case, the worm gear has external teeth formed at a portion thereof and is locked when the external teeth thereof is in mesh with the internal teeth of the lock member. The worm gear is locked or unlocked by moving the lock member in a direction axially of the worm gear.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives and features of the present invention will become more apparent from the following description of preferred embodiments thereof with reference to the accompanying drawings, throughout which like parts are designated by like reference numerals, and wherein:

Fig. 1 is a perspective view of a reclining seat according to a first embodiment of the present invention;

Fig. 2 is a perspective view of the reclining seat of Fig. 1, particularly depicting the condition in which a seat back has been inclined backward;

Fig. 3 is an exploded perspective view of a reclining mechanism mounted on the reclining seat of Fig. 1;

Fig. 4 is an exploded perspective view of a lock mechanism in the reclining mechanism of Fig. 3;

Fig. 5 is a fragmentary perspective view, on an enlarged scale, of an essential portion of the lock mechanism of Fig. 4;

Fig. 6 is a perspective view of the reclining mechanism when locked;

Fig. 7 is a perspective view of the reclining mechanism when unlocked; and

5 Fig. 8 is a perspective view of a reclining seat according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This application is based on application No. 9-64267 filed March 18, 1997 in Japan, the content of which is incorporated hereby
10 reference.

Referring now to the drawings, there is shown in Figs. 1 and 2 a reclining seat S1 embodying the present invention. The reclining seat S1 shown therein includes a seat cushion 2 and a seat back 4 pivotally mounted on the seat cushion 2 via a reclining mechanism R. The seat
15 cushion 2 and the seat back 4 accommodate a seat cushion frame (not shown) and a seat back frame (not shown), respectively.

As shown in Fig. 3, the reclining mechanism R includes a plurality of links 6, 8 and 10 for pivotally connecting the seat back 4 to the seat cushion 2. Of the plurality of links 6, 8 and 10, the two links 6 and 8
20 extend generally parallel to each other and have respective upper ends connected to opposite ends of the link 10. The link 6 is secured to the seat back frame and has a lower end rotatably mounted via a pin 16 on a pair of brackets 12 and 14 secured to the seat cushion frame. The lower end of the link 6 is a center of rotation of the seat back 4.

25 The link 8 has internal teeth 8a formed at a lower end thereof and being in mesh with external teeth 18a formed on a rod 18 that is a center of rotation of the reclining mechanism R. The rod 18 has a notch 18b defined therein at one end thereof in which one end of a coil spring 20 is

engaged, while the other end of the coil spring 20 is engaged with a pin 22 fixedly mounted on the bracket 12, thereby always biasing the seat back 4 forward.

A sector gear 26 is interposed between the pair of brackets 12 and 14 via two retainer rings 22 and 24 disposed on respective sides of the sector gear 26. The sector gear 26 has internal teeth 26a formed therein that are in mesh with the external teeth 18a of the rod 18. As shown in Fig. 4, the pair of brackets 12 and 14 are screwed at front and rear ends thereof to a pair of bearings 30 and 32 in which a worm gear 28 in mesh with the sector gear 26 is journaled.

As shown in Figs. 4 and 5, the worm gear 28 has external teeth 28a formed at an intermediate portion thereof that are engageable with internal teeth 34a formed in a generally cross-shaped lock member 34 to lock the worm gear 28. The lock member 34 is slidably mounted on the seat cushion 2 and is held by a generally U-shaped holder 36 that is connected to an operating knob 40 via a rod 38. The lock member 34 is biased by a coil spring 42 in the direction in which the internal teeth 34a of the lock member 34 are held in mesh with the external teeth 28a of the worm gear 28.

Each of the sector gear 26 and the worm gear 28 in mesh with each other has a lead angle greater than the angle of friction thereof. Under the condition in which locking of the worm gear 28 by the lock member 34 has been released, the seat back 4 is easily inclined forward by the action of a biasing force of the coil spring 20, while the seat back 4 is inclined backward by applying a backward force (load) to the seat back 4. That is, inclination of the sector gear 26 results in rotation of the worm gear 28.

It is to be noted that because the reclining seat shown in Figs. 3

and 4 is disposed on only one side of the seat, it is sufficient if another set of links 6, 8 and 10 as shown in Fig. 3 is mounted on the seat cushion on the other side of the seat using two pins (identical to pin 16).

The reclining seat of the above-described construction operates
5 as follows.

As shown in Fig. 6, under the ordinary condition in which the operating knob 40 is not operated, the internal teeth 34a of the lock member 34 are held in mesh with the external teeth 28a of the worm gear 28 by the action of a biasing force of the coil spring 42 (omitted in Fig. 6),
10 thereby preventing rotation of the worm gear 28. Under this condition, because rotation of the sector gear 26 in mesh with the worm gear 28 is also prevented, the plurality of links 6, 8 and 10 are retained at the present position. Accordingly, neither the biasing force of the coil spring 20 nor the application of a backward force to the seat back 4 can incline the seat back
15 4.

On the other hand, when changing the angle of inclination of the seat back 4 is desired, pulling the operating knob 40 as shown by an arrow B in Fig. 7 causes the lock member 34 to move in a direction axially of the worm gear 28 (in the direction shown by the arrow B) via the rod 38 and
20 the holder 36, thus releasing the locking of the worm gear 28 by the lock member 34. When a forward inclination of the seat back 4 is desired, it is sufficient if the seat occupant merely leans forward. This causes the biasing force of the coil spring 20 to rotate the rod 18 and the sector gear 26 in a direction shown by an arrow A in Fig. 3. Because the lead angle of the
25 worm gear 28 in mesh with the sector gear 26 is greater than the angle of friction thereof with the sector gear 26, a rotational force applied to the sector gear 26 rotates the worm gear 28 together with the sector gear 26. As a result, the links 6 and 8 incline forward to incline the seat back 4

forward about the lower end of the link 6. When the operating knob 40 is released at a desired position, the biasing force of the coil spring 42 moves the lock member 34 in a direction opposite to the arrow B in Fig. 7 so that the internal teeth 34a of the lock member 34 may mesh with the external teeth 28a of the worm gear 28 again, thus preventing rotation of the worm gear 28 and maintaining the angle of inclination of the seat back 4.

In contrast, when a backward inclination of the seat back 4 is desired, it is sufficient if a backward force is applied to the seat back 4 under the condition in which the operating knob 40 has been pulled. This causes the worm gear 28 to rotate in a direction opposite to the case where the seat back 4 is inclined forward. Rotation of the worm gear 28 is followed by rotation of the sector gear 26, which in turn causes a backward inclination of the seat back 4 via the links 6, 8 and 10. When the operating knob 40 is released at a desired position, the worm gear 28 is locked again by the lock member 34 to maintain the angle of inclination of the seat back 4.

In the reclining seat S1 discussed above, because the seat back 4 accommodates only the links 6, 8 and 10 and no mating parts, the seat back 4 can be extremely easily manufactured at a low cost.

Fig. 8 depicts a reclining seat S2 according to a second embodiment of the present invention in which the links 6, 8 and 10 are disposed outside the seat back 4.

This construction further facilitates the manufacture of the seat back 4, because it is sufficient if only the link 6 is secured to the seat back frame, and it is not necessary to incorporate component parts constituting the reclining mechanism into the seat back 4. Because the operation of the reclining seat S2 shown in Fig. 8 is identical to that of the reclining seat S1 shown in Figs. 1 and 2, explanation thereof is omitted.

In each of the reclining seats S1 and S2 referred to above, the lower end of the link 8 is employed as the center of rotation of the reclining mechanism, while the lower end of the link 6 spaced apart therefrom is employed as the center of rotation of the seat back 4. Accordingly, the distance between the center of rotation of the seat back 4 and a greater trochanter of a seat occupant can be shortened compared with conventional reclining seats. Because the hip of the seat occupant does not slide on the seat when the seat back 4 is inclined, the reclining seat S1 or S2 gives the seat occupant no unpleasant feeling.

Furthermore, if a relatively large impact force is applied to the seat due to, for example, a vehicle collision, the two links 6 and 8 extending generally parallel to each other are deformed to absorb impact energy, thereby making the seat occupant safe.

Also, because each of the sector gear and the worm gear in mesh with each other has a lead angle greater than the angle of friction thereof, not only can the seat back be readily inclined but also the angle of inclination thereof can be steplessly adjusted by releasing locking of the worm gear and applying a force to the seat back.

The locking or unlocking of the worm gear is positively accomplished by a simple construction. That is, the locking or unlocking of the worm gear can be carried out merely by moving the lock member in a direction axially of the worm gear.

Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art. Therefore, unless such changes and modifications otherwise depart from the spirit and scope of the present invention, they should be construed as being included therein.

What is claimed is:

1 1. A reclining seat comprising:
2 a seat cushion;
3 a seat back pivotally mounted on said seat cushion and having
4 a center of rotation; and
5 a reclining mechanism for inclining said seat back relative to
6 said seat cushion, said reclining mechanism having a center of rotation
7 spaced apart from the center of rotation of the seat back,
8 wherein the center of rotation of said seat back is positioned
9 closer than the center of rotation of said reclining mechanism to a seat
10 occupant.

1 2. The reclining seat according to claim 1, wherein said seat
2 cushion has a seat cushion frame accommodated therein and said reclining
3 mechanism comprises first and second links having respective first ends
4 rotatably mounted on said seat cushion frame and also having respective
5 second ends connected to each other, and wherein the first end of said first
6 link is employed as the center of rotation of said seat back, while the first
7 end of said second link is employed as the center of rotation of said reclining
8 mechanism.

1 3. The reclining seat according to claim 2, further comprising a
2 sector gear connected to the first end of said second link and a worm gear
3 rotatably mounted on said seat cushion and being in mesh with said sector
4 gear, wherein each of said sector gear and said worm gear has a lead angle
5 greater than an angle of friction thereof, and wherein when locking of said
6 worm gear has been released, said seat back is inclined by applying a force
7 to said seat back.

1 4. The reclining seat according to claim 3, further comprising a
2 lock member mounted on said seat cushion and having internal teeth

3 formed therein, wherein said worm gear has external teeth formed at a
4 portion thereof and is locked when the external teeth thereof is in mesh
5 with the internal teeth of said lock member, and wherein said worm gear is
6 locked or unlocked by moving said lock member in a direction axially of said
7 worm gear.

ABSTRACT OF THE DISCLOSURE

A reclining seat includes a seat cushion, a seat back pivotally mounted on the seat cushion, and a reclining mechanism for inclining the
5 seat back relative to the seat cushion. A center of rotation of the reclining mechanism is spaced apart from that of the seat back. The center of rotation of the seat back is positioned closer than that of the reclining mechanism to a seat occupant.

Fig. 1

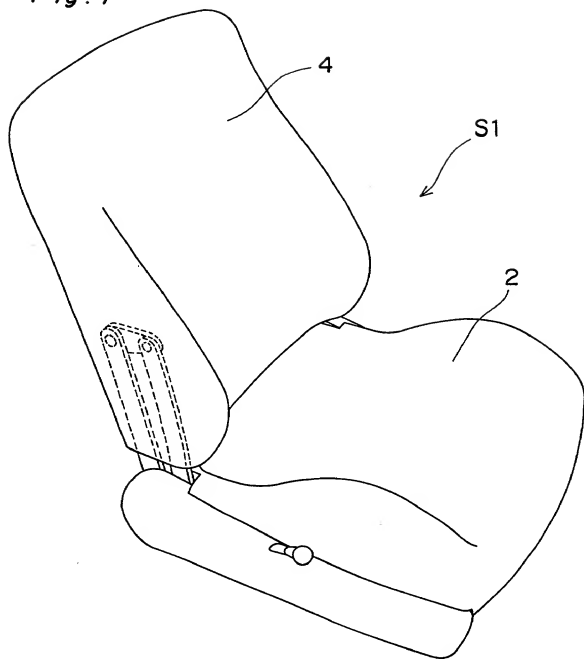


Fig. 2

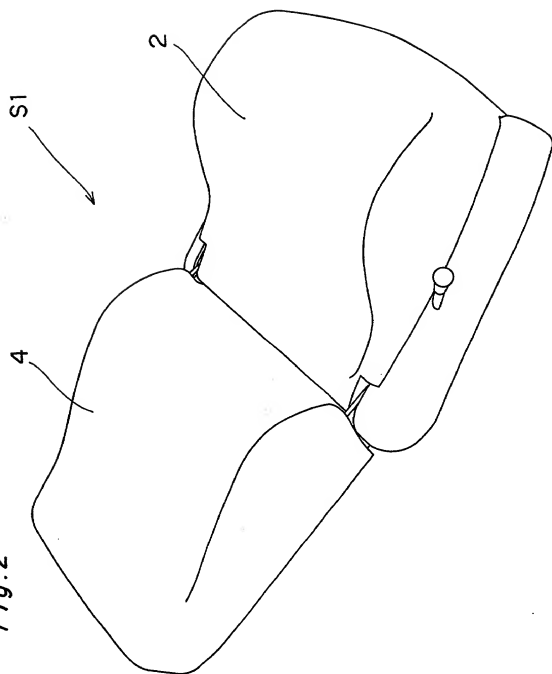


Fig. 3

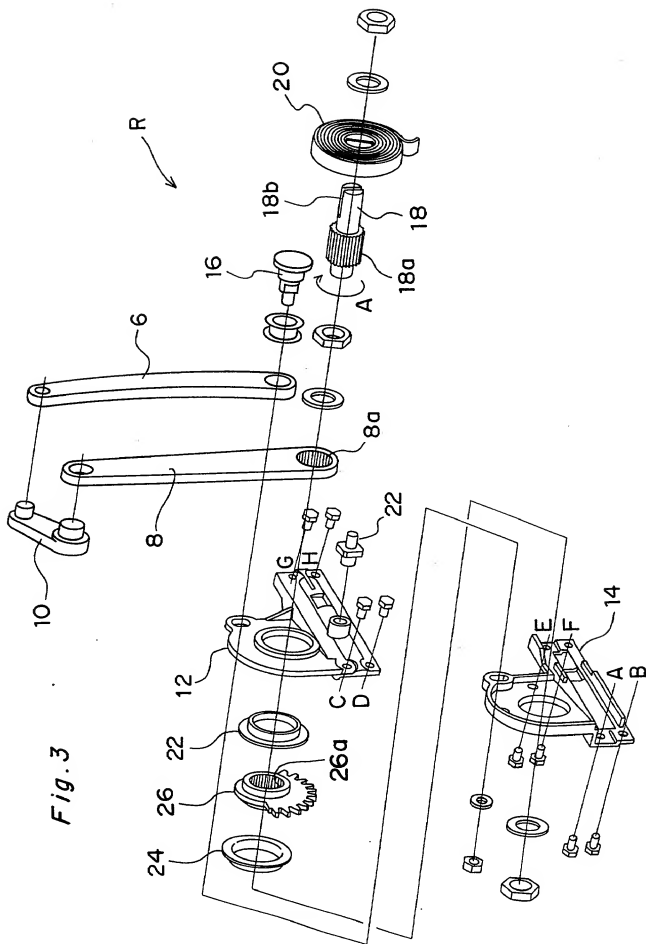


Fig. 4

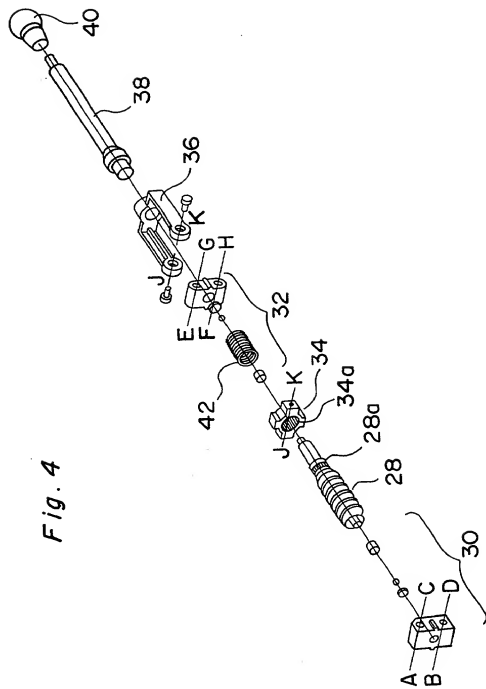


Fig. 5

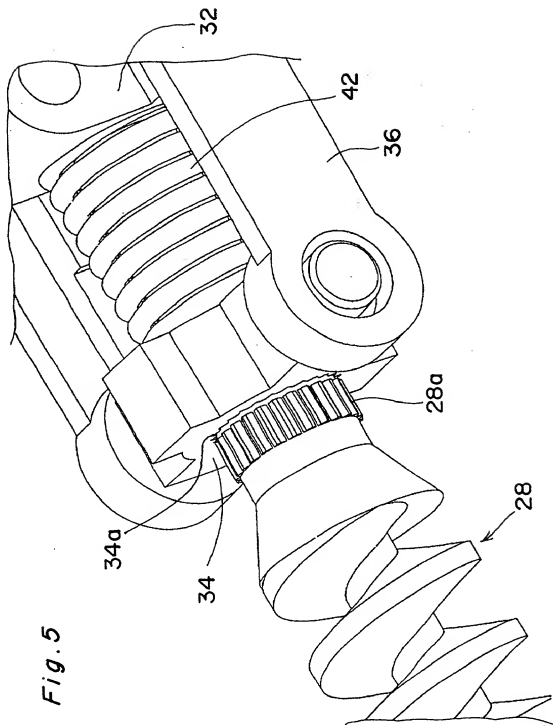
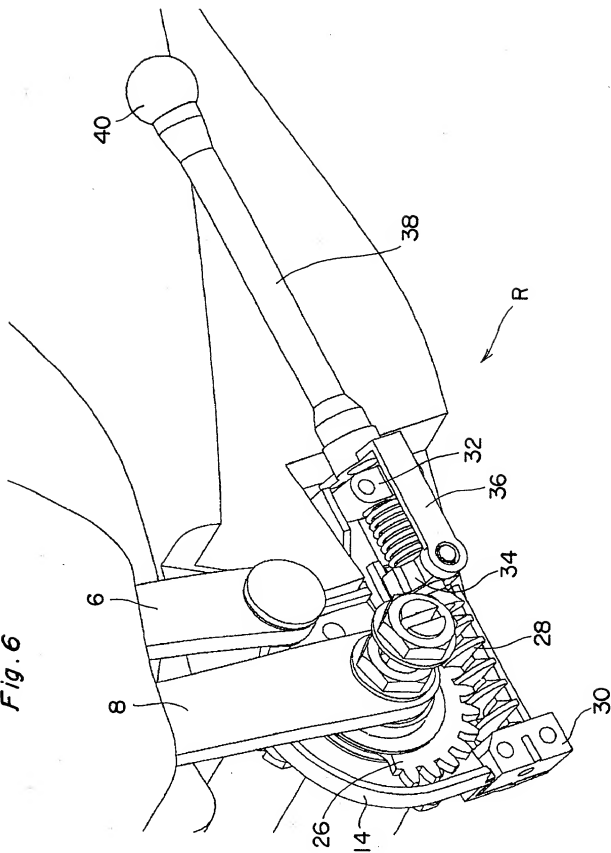


Fig. 6



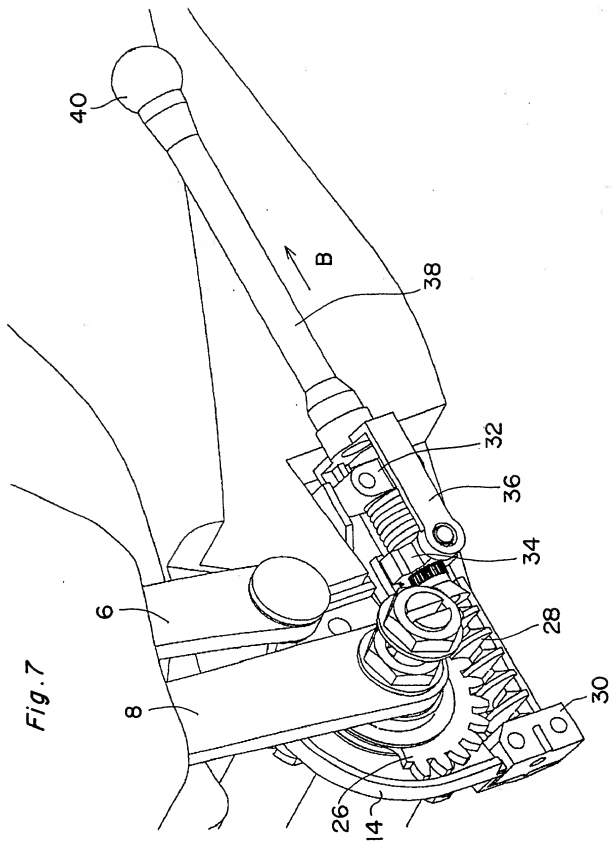
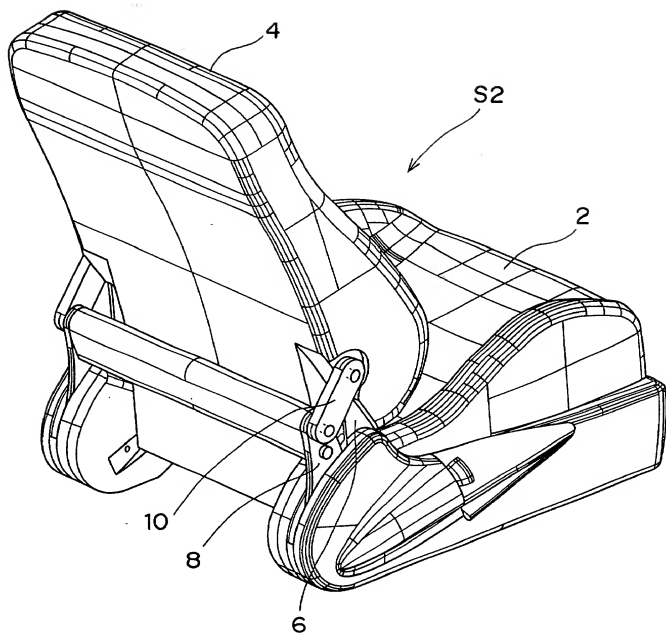


Fig. 8



DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATION

(X) Original () Supplemental () Substitute () PCT () Design

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: Reclining Seat

of which is described and claimed in:

(X) the attached specification, or

() the specification in the application Serial No. _____ filed _____;

and with amendments through _____ (if applicable), or

() the specification in International Application No. PCT/_____, filed _____, and as amended on _____ (if applicable).

I hereby state that I have reviewed and understand the content of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim priority benefits under Title 35, United States Code, §119 (and §172 if this application is for a Design) of any application(s) for patent or inventor's certificate listed below and have also identified below any application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
Japan	P 09-064267	March 18, 1997	No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	U.S. FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

And I hereby appoint John T. Miller, Reg. No. 21,120; Michael R. Davis, Reg. No. 25,134; Matthew M. Jacob, Reg. No. 25,154; Jeffrey Noltan, Reg. No. 25,408; Warren M. Cheek, Jr., Reg. No. 33,367; Nils E. Pedersen, Reg. No. 33,145 and Charles R. Watts, Reg. No. 33,142, who together constitute the firm of WENDEROTH, LIND & PONACK, L.L.P., attorneys to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith.

I hereby authorize the U.S. attorneys named herein to accept and follow instructions from AOYAMA & PARTNERS as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and myself. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by me.

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Post Office Address	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE

Full Name of Seventh Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE

I further declare that all statements made herein of my own knowledge are true, and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1st Inventor Seiji Kawasaki Date July 28, 1998

2nd Inventor _____ Date _____

3rd Inventor _____ Date _____

4th Inventor _____ Date _____

5th Inventor _____ Date _____

6th Inventor _____ Date _____

7th Inventor _____ Date _____

The above application may be more particularly identified as follows:

U.S. Application Serial No. _____ Filing Date _____

Applicant Reference Number 527929 DLH Atty Docket No. _____

Title of Invention Reclining Seat